Biological Effectiveness Studies of Commercially Available Ballast Treatment Systems

Presentation by:
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Washington, DC


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Great Lakes Ballast Technology Demonstration Project

Summary of Project Goal and Objectives

- Usher-in the era in which on-board ballast treatment is a real and available option for ships and governments
  - Conducting early trials to inform R&D, standard-setting and protocol development
  - Exploring installation and design concerns/realities
  - Transmitting information directly to policy fora
  - Drawing recognition to treatment industry and its financial opportunities


GREAT LAKES
BALLAST TECHNOLOGY DEMONSTRATION PROJECT
BIOLOGICAL SAMPLING TANKS
ULTRAVIOLET
FILTER
HYDROCYCLONE
DIESEL PUMP
CO-CHAIRS
RICK HARKINS – LAKE CARRIERS' ASSOCIATION
ALLEGRA CANGELOSI – NORTHEAST MIDWEST INSTITUTE

Barge Platform Tests
Technologies

- **1998** - 25 um vs. 50 um Screen Filtration
- **2000** - 40 um Screen Filtration + Ultra Violet Radiation **vs.** Cyclonic Separation + Ultra Violet Radiation
- **2001** - 100 um Depth Filtration + Stronger UV

Filtration (ABSF)


'98 9 8

Cyclonic Separation

Depth Filter (100 um)

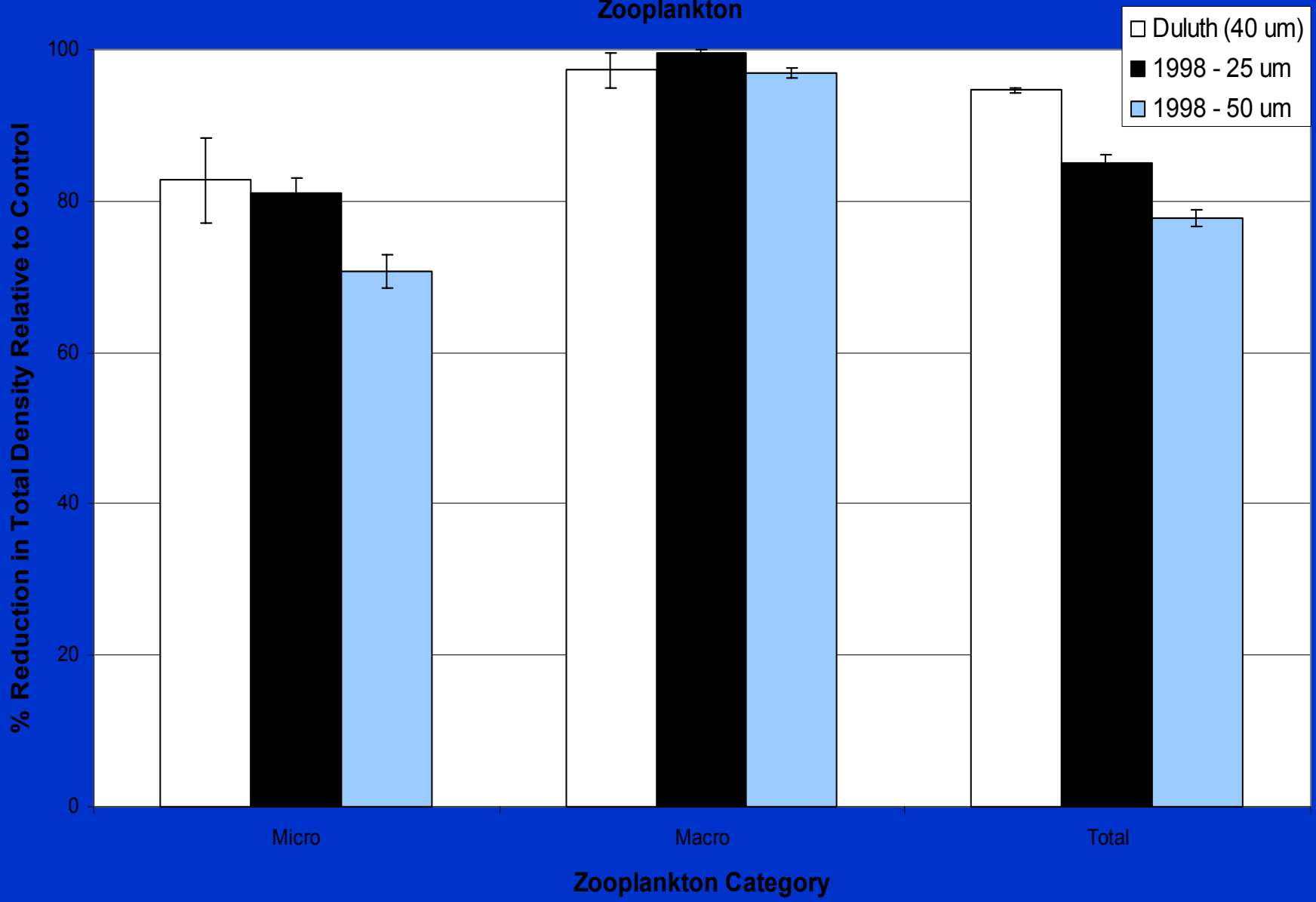
UV Radiation

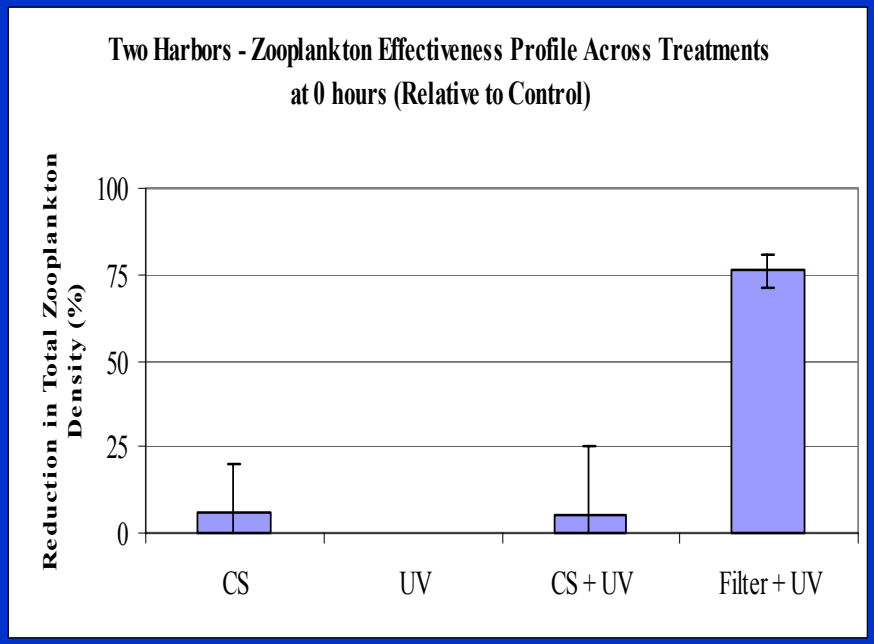
Range of Biotic Groups, Assays

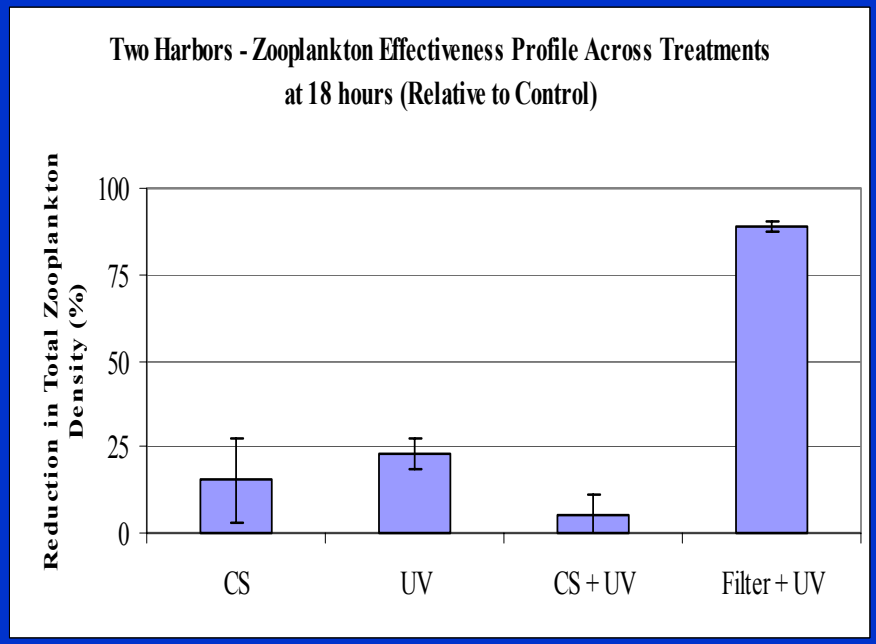
- Zooplankton (Ambient)
  - total density across taxa (1998, 2000)
  - live density across taxa (2000, 2001)
- Phytoplankton (Ambient)
  - total density of individual taxa (1998, 2001)
  - initial Chlorophyll a (1998, 2000, 2001)
  - incubated Chlorophyll a (2000 + 2001)
- Bacteria (Ambient) and Viruses (Spiked)
  - total culturable bacteria (1998, 2000, 2001)
  - spiked coliphage (2000, 2001)

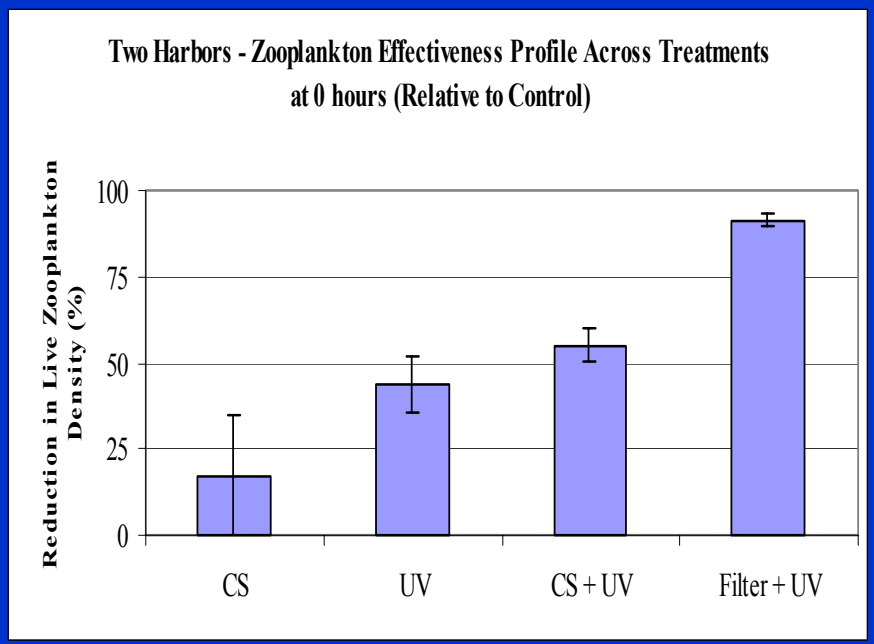

GEORGE A. STINSON

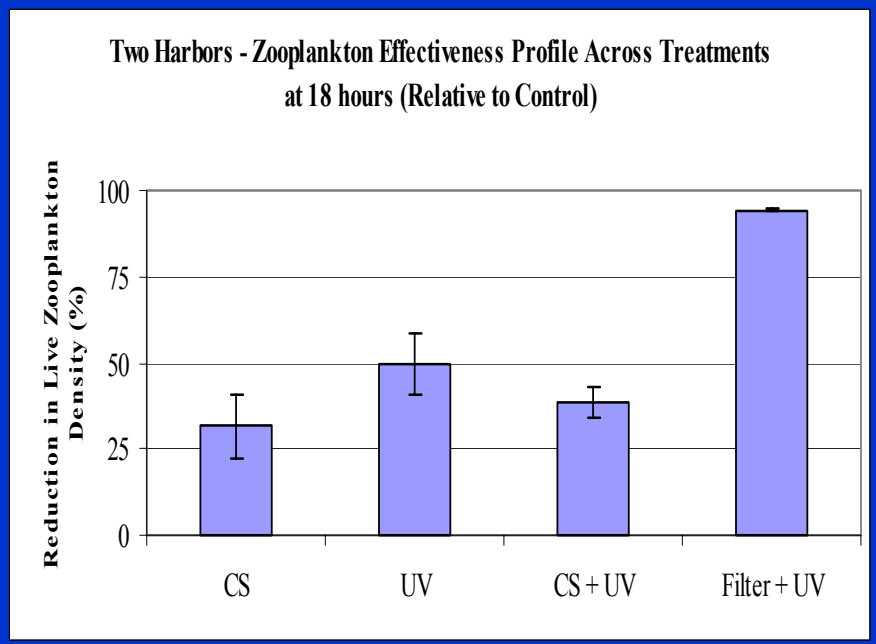
Fig 10. Relative Efficiencies for the 25 µm (1998), 40 µm (2000) and 50 µm (1998) Screens at Reducing Total Zooplankton Density of Macrozooplankton, Microzooplankton and Total Zooplankton




Two Harbors - Zooplankton Effectiveness Profile Across Treatments
at 0 hours (Relative to Control)
Reduction in Total Zooplankton Density (%)
100
75
50
25
0
CS
UV
CS + UV
Filter + UV


Two Harbors - Zooplankton Effectiveness Profile Across Treatments
at 18 hours (Relative to Control)
Reduction in Total Zooplankton Density (%)
100
75
50
25
0
CS
UV
CS + UV
Filter + UV


Two Harbors - Zooplankton Effectiveness Profile Across Treatments
at 0 hours (Relative to Control)
Reduction in Live Zooplankton Density (%)
100
75
50
25
0
CS
UV
CS + UV
Filter + UV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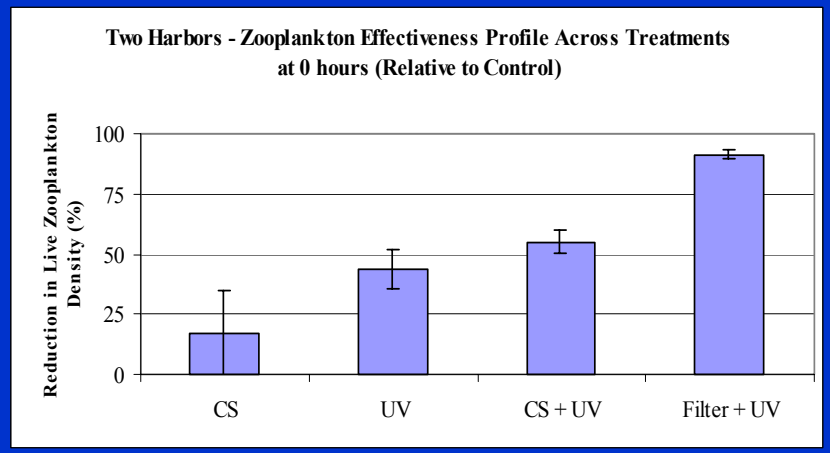
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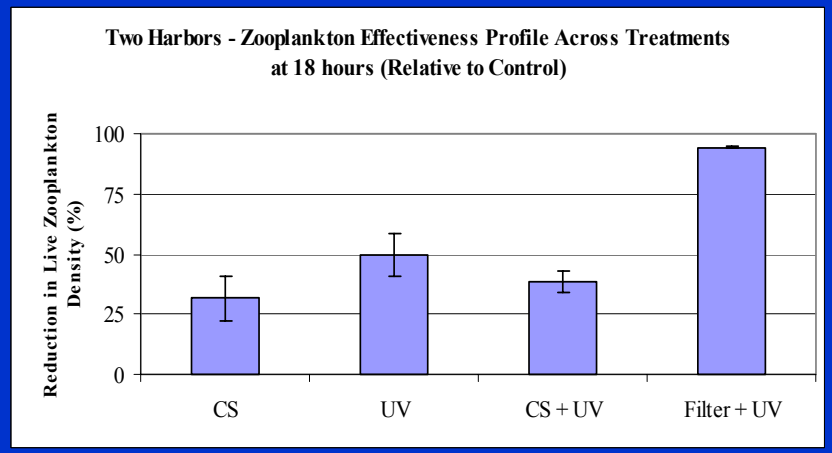
Filter + UV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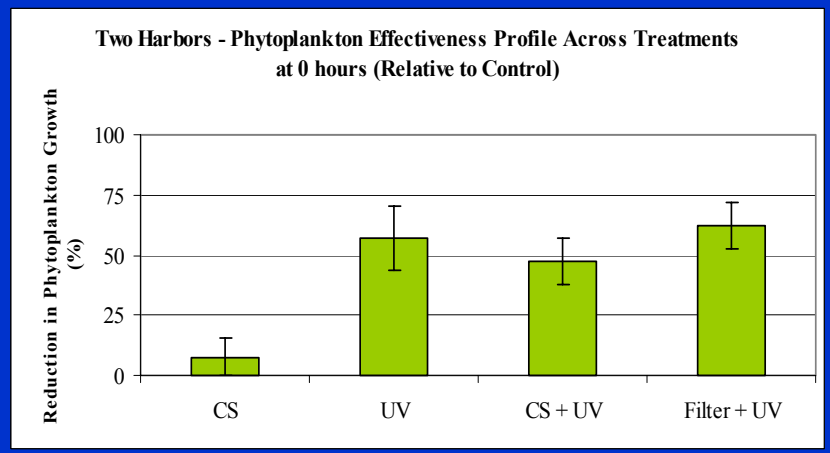
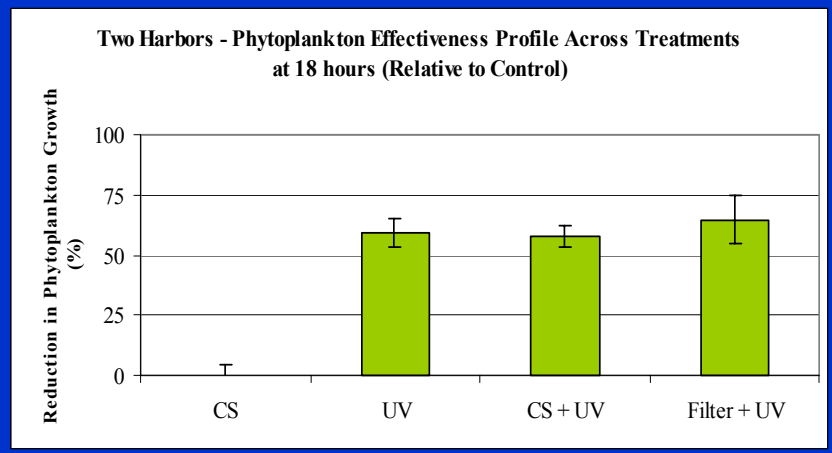
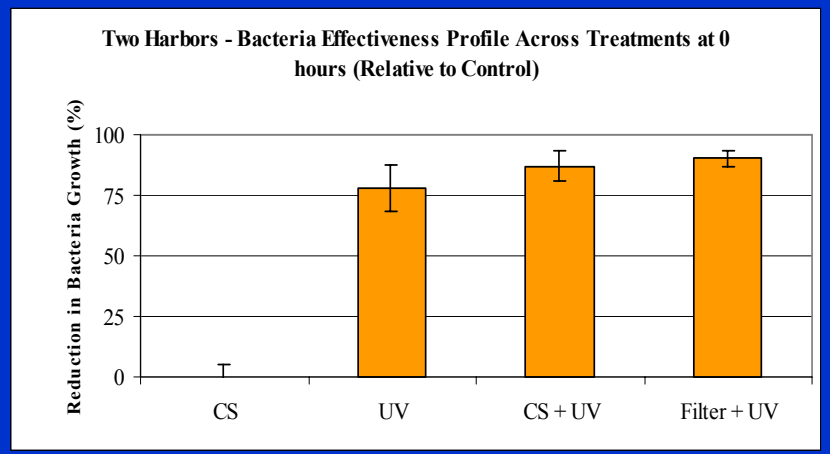
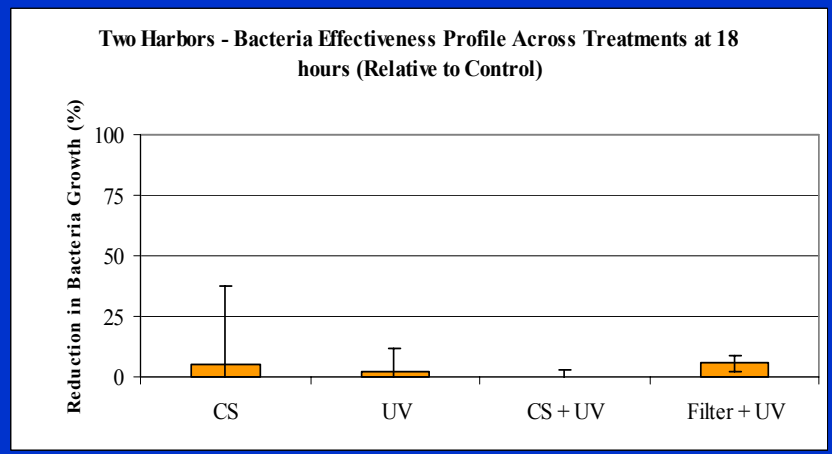
25
0
CS
UV
CS + UV
Filter + UV


Two Harbors - Phytoplankton Effectiveness Profile Across Treatments at 0 hours (Relative to Control)
Reduction in Phytoplankton Growth (%)
100
75
50
25
0
CS
UV
CS + UV
Filter + UV


Two Harbors - Phytoplankton Effectiveness Profile Across Treatments at 18 hours (Relative to Control)
Reduction in Phytoplankton Growth (%)
100
75
50
25
0
CS
UV
CS + UV
Filter + UV


Two Harbors - Bacteria Effectiveness Profile Across Treatments at 0 hours (Relative to Control)
Reduction in Bacteria Growth (%)
100
75
50
25
0
CS
UV
CS + UV
Filter + UV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Reduction in Bacteria Growth (%)
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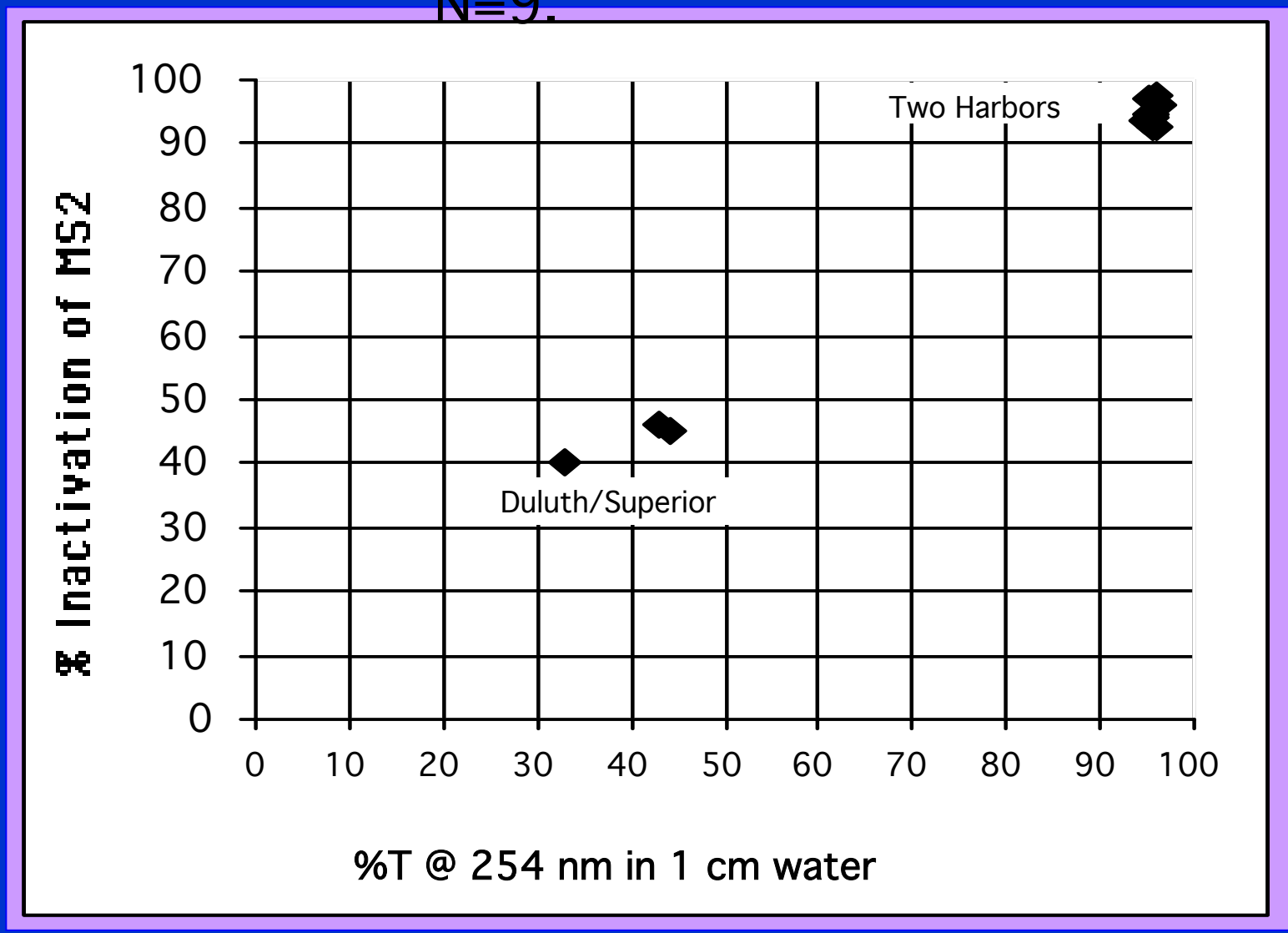
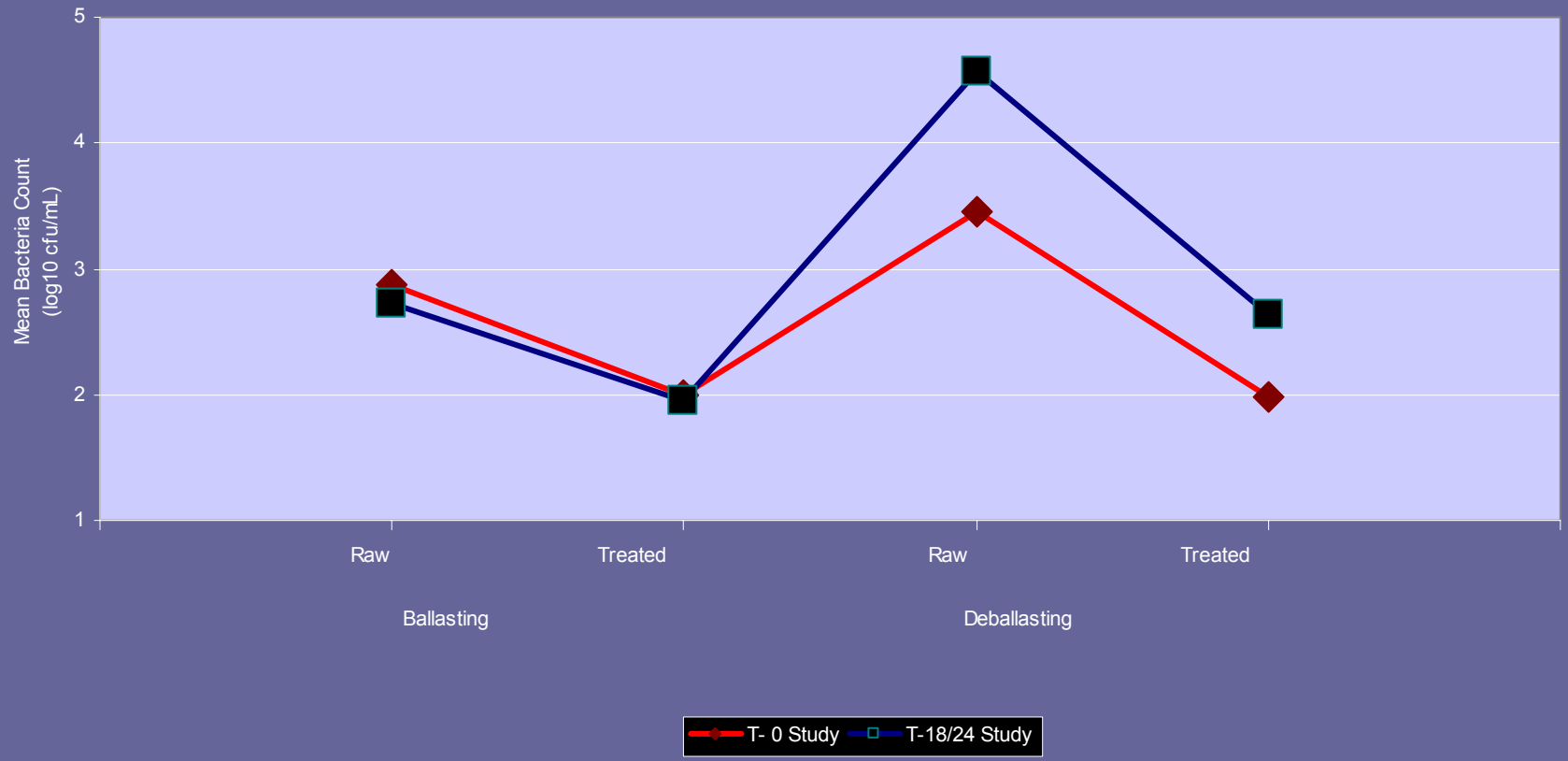
Relationship between UV transmittance of treated (UV only) water and effectiveness of inactivation of MS2. Duluth/Superior Harbor N=3; Two Harbors N=9.




MV Regal Princess - 2000
(880 GPM)

Regal Princess--Effects of CS/UV Treatment and Retention in Ballast Tank on Culturable Bacteria



Full-Scale Design Studies

- Teams of Treatment Vendors, Ship Owners, and Marine Engineers
- Retrofit/Design-in for Actual Ships
  - RJ Pfeiffer
  - Polar Endeavor
  - FedNav Vessel
- Findings by Fall 2001

International Ballast Technology

Investment Fair

September 20-21, 2001

Chicago Navy Pier, Chicago, IL

NORTHEAST MIDWEST INSTITUTE

http://www.nemw.org/fair_about.htm

Lake Carriers' Association

Great Lakes Protection Fund

M/T Aspiration

- Effectiveness of full-scale installation of CS + UV
- Highly turbid and varied source harbor conditions
- Possible collaboration to allow direct comparison with BWE
- Installation Fall 2001
- Tests 2002

Biological Research Team

- Allegra Cangelosi, NE-MW Institute
- Mary Balcer, University of Wisconsin
- Chip Blatchley, Purdue University
- Dave Wright and Rodger Dawson, University of Maryland
- Xenqing Gao, Kent Sate University
- Anwar Huq, Maryland Biotechnology Institute
- Ivor Knight, James Madison University
- Donald Reid, Consultant
- Nicole Mays and Jessica Taverna, NEMWI
- Rochelle Sturtevant, NOAA

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- US Coast Guard
- Rick Harkins, Lake Carriers' Association
- Collaborators
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  - Algoma Central Marine, Stolt-Nielsen, PCL
  - Optimarin, Ontario Hydro, Arkal
  - Officers and Crew: MV Algonorth; MV Regal Princess, M/T Aspiration